

COURSE OUTCOME

Department of Physics: Morigaon College

First Semester (Major):

Paper: 101 Mathematical Methods (I) and Mechanics:

Vector calculus plays an important role in differential geometry and in the study of partial differential equations. It is used extensively in physics and engineering, especially in the electromagnetic fields and fluid flow.

The algebraic (non-differential) operations in vector calculus are referred to as vector algebra, being defined for a vector space and then globally applied to a vector field.

Paper: 102 (a) Waves and oscillations:

Harmonic motion gives the knowledge of composition of two simple harmonic motion and the construction of Lissajous figures. It also gives the true knowledge of various types of oscillations.

Wave motion chapter describes the various mathematical equation of wave motion and the characteristics of various waves.

Sound waves chapter describes the velocity of sound waves in different medium and the acoustics of an auditorium.

Fourier analysis chapter gives the knowledge about how we can construct and analysis the square waves, saw tooth waves, etc. It also gives the knowledge of energy of stretched string and also about plucked and struck string.

(b) Ray optics:

Fermat's Principle can be used to establish laws of reflection and refraction at spherical surface.

Matrix method is used in refraction at spherical surface and at thin lenses.

Lens system gives the relation among various magnifications.

Defect of image chapter gives the knowledge of various aberrations and various methods to minimize the aberrations.

Paper 103:

(a) TEST OF LABORATORY SKILL:

1. The students are made to identify active and passive components of an electronic circuit.

2. The students are made familiarize with operation of basic measuring and test equipments(analog and digital multimeters, function generator, Cathode ray oscilloscope)
3. The students are made to use a multimeter for identification of different terminals of (i) diode and (ii) transistor.
4. The students are made to find the value of resistor from colour code and verify by measuring the resistance by multimeter.
5. The students are made to make connections using soldering.
6. The students are made to measure small distances and angles using different vernier scales attached to (i) traveling microscope, (ii) polarimeter and (iii) spectrometer.
7. The students are made to check the condition of a lead-acid battery – (i) acid strength by common hydrometer, (ii) acid level and (iii) emf (using multimeter).
8. The students are made to check the condition of capacitor using multimeter.

(b) PRACTICAL:

1. The students are made to measure the extension of an experimental wire due to different pulling forces using Searle's apparatus and hence determine the Young's modulus of the material of the wire.
2. The students are made to Study the variation of angle of twist of a given rod at different lengths from the fixed end, with torque & then determine the rigidity modulus of the material of the rod.
3. The students are made to study the variation of time period of a bar pendulum about different point of suspension and use the result to find the value of g at a place.
4. The students are made to determine the frequency of a tuning fork by Melde's experiment.
5. The students are made to determine the moment of inertia of a cylinder or a rectangular parallelepiped about two different axes of symmetry by torsional oscillation method.
6. The students are made to determine the spring constant and mass from vertical oscillations of a loaded spring and hence to determine the modulus of rigidity of the material of the spring.

Second Semester

Paper 201:

(a) **Mathematical Methods – II**: In geometry, curvilinear co-ordinates are a co-ordinate system for Euclidean space in which the co-ordinate lines may be curved. This chapter describes the dimensional space, the intersection of two co-ordinates surface.

(b) **Properties of Matter**: Elasticity chapter describes the different types of elastic constants, bending of beam, etc.

Surface energy, excess pressure, etc.

Viscosity chapter gives the expression for poiseuilles equation

Paper 202:

(a) **Heat and Thermodynamics**: Kinetic theory of gases chapter gives the expression for pressure of a gas, degrees of freedom, Maxwell law of velocity distribution, mean free path, Brownian motion, etc.

Equation of state of a gas chapter gives the knowledge of Andrew's experiment, thermal conductivity, platinum resistance thermometer.

Various thermodynamic laws gives the knowledge of carnot cycle heat engine. This chapter also explains the various thermodynamic scale of temperature and knowledge of entropy.

The chapter about Maxwell's thermodynamic relations and their applications also explains about triple point, Joule-Thomson effect and about blackbody radiation.

PAPER: 203 (PRACTICAL)

1. The students are made to determine the focal length of a given convex mirror with the help of a convex lens.
2. The students are made to determine the coefficient of linear expansion of the material of given metal rod by optical lever method.
3. The students are made to determine the value of J, the mechanical equivalent of heat by Joule's calorimeter.
4. The students are made to study the variation of resistance of a thermistor with temperature and then to measure an unknown temperature of a liquid with it.
5. The students are made to determine the refractive index of a liquid by using a plane mirror and a convex lens.
6. The students are made to convert a given galvanometer into a voltmeter of given range and than calibrate it with help of an ammeter and standard resistance.

7. The students are made to determine the temperature of the filament of a torch bulb by studying the change of its resistance with current and known value of temperature coefficient of the material of the filament.

Third Semester

Paper 301:

- (a) **Mathematical Methods – III**: Matrix multiplication plays very important role in many scientific disciplines because of the fact that it is considered as the main tool for many other computation in different areas, like those in seismic analysis etc.
- (b) **Electrostatics**: This chapter gives the knowledge about electric field of various charged bodies.

This chapter also gives the knowledge of Gauss's law and its applications, electric field and potential of various charged bodies.

The chapter also gives the knowledge of electrostatic energy and the electrical images with examples.

The chapter also explains in details about dielectric permittivity, etc.

Paper 302:

- (a) **Current electricity**: This chapter explains how to solve the problems of electrical network, basic principle of self and mutual inductances and their determinations.

This chapter also gives the knowledge to observe transient growth and decay of current for LR, CR, LCR circuit and their analysis. It also gives the knowledge of quality factor of an AC circuit, Anderson's bridge.

It also gives the knowledge about transformers.

- (b) **Magnetostatics**: This chapter gives the knowledge of magnetic field, Lorentz force, Bio-savart Law, etc.

It gives the knowledge about how to calculate the magnetic field due to various conductors.

PAPER: 303 (PRACTICAL)

1. The students are made to determine the horizontal component of earth's magnetic field with the help of a tangent galvanometer and copper voltameter.
2. The students are made to determine the current flowing through an external circuit using potentiometer.
3. The students are made to compare the values of two given low resistances using a potentiometer.
4. The students are made to determine the internal resistance of a given cell using a potentiometer.
5. The students are made to determine the value of a given low resistance by drop of potential method using a meter bridge. 6. To determine the end correction of a meter bridge and then to determine the specific resistance of the material of a given wire with help of the meter bridge using end correction.

6. The students are made to convert a given galvanometer into an ammeter of given range and then calibrate it with the help of a copper voltameter.

Fourth Semester

Paper 401:

- (a) **Mathematical Methods – IV**: This chapter gives the knowledge of differential equations of various types. It also gives the knowledge of probability theory.
- (b) Introduction to computer and computer programming: From this chapter the students will learn about the programming languages i.e FORTRAN – 95, C and C++

Paper 402:

- (a) **Wave Optics**: Interference chapter gives the concept of light wave and its equation, meaning of coherence, interference fringes, interference by Fresnel's biprism, Newton's rings, etc.
Diffraction chapter explains about various types of diffractions in details, knowledge of grating and its resolving power.
Polarisation chapter gives the knowledge of production and analyzing of different polarized light, specific rotation, etc.
- (b) **Special Theory of Relativity**: This chapter gives the knowledge of Lorentz transformation, length contraction, time dilation and their application to physical situation. It also gives knowledge of Doppler effect and twin paradox.
This chapter explains the equivalence of mass and energy, concept of space-time and Minkowski space.

PAPER: 403 (PRACTICAL)

1. The students are made to adjust and focus the given spectrometer using Schuster's method and then determine the refractive index of the material of the prism.
2. The students are made to determine the width of a single slit by observing the diffraction pattern of monochromatic light.
3. The students are made to determine the focal length of two lenses and their combination by displacement method.
4. The students are made to determine the wavelength of light emitted by a monochromatic source with the help of Newton's ring arrangement.
5. The students are made to study the variation in liquid column height with diameter of capillary tube and determine the surface tension of the liquid.
6. The students are made to determine the value of acceleration due to gravity using Katter's Pendulum.
7. The students are made to study the variation of optical rotation with concentration for sugar solution using polarimeter and Sodium light and hence determine the specific rotation of sugar.

Fifth semester

Paper 501:

- (a) **Mathematical Methods – V**: This chapter explains about De-Moiver's theorem, Cauchy integral theorem, Taylor and Laurent series and their applications.
- (b) **Classical Mechanics**: This chapter explains about central force motion and its properties, energy diagram and nature of orbits.
It also explains the application of central force problems.
It explains the Lagrange's equation of motion and its applications, Hamilton's principle, Kepler's problem and Poisson brackets.

Paper 502:

- (a) **Atomic Physics**: This chapter gives the knowledge of Rutherford scattering experiment and his atom model.
It also gives the knowledge as how Bohr removed the drawbacks of Rutherford's atom model and the Sommerfeld modified atom model.
It also explains the Pauli's exclusion principle, Zeeman effect, Stark effect, etc.
This chapter also explains how light is scattered by air and liquid molecules, Raman effect and its applications.

Paper 503:

- (a) **Quantum Mechanics**: This chapter explains the blackbody radiation and Planck's quantum theory.
The chapter also gives the knowledge of De-Broglie wave and its experimental verification.
The chapter also explains about uncertainty principle and its applications.
The chapter also explains about probability density, normalization of wave function, etc.
The chapter also gives the knowledge about operators, Schrodinger equation and its various application in details.
- (b) **Astrophysics**: This chapter explains about celestial co-ordinate system and identifications of the constellations and stars.
It also explains about GMT, stellar magnitude system and distance measurement.
It also gives the knowledge of spectral classification and H.R diagram.

Paper 504:

Electronics:

1. Students will learn the relation of voltage of Ampere in P-N junction diode. They will have a brief idea of the Energy bands of diode. LED, Varactor-diode and Zener diode applications are learnt.
 - C lipping and C lamping circuits are discussed.
 - They learn the principle of voltage regulation and hence they often can make a regulated power supply of their own.
2. Different important network theorems are discussed so that they are able to solve complex network with a good numerical approach. In this curriculum, Thevenin, Norton, Miliment theorems are discussed along with the very important maximum power transfer theorem.
3. A basic idea of transistor is learnt.
 - The different modes of operations and characteristics are studied briefly
 - They get the idea of how the transistor works as an amplifier
 - Load line and operating point (Q-point) along with the stabilization of the Q-point are studied
 - They get to know about the biasing of the transisting circuit and they also learn about two-part (4-terminals) device, where z, h and y parameters are discussed.
 - The gains, like, voltage gain, power gain and input gain with the input and output impedance are discussed.
 - They know about the varities of amplifiers, Class A, Class B, Class C, Cascade amplifiers.
 - A brief idea of small signal analysis is picturised among the students.
 - Phase relation between input and output are discussed.
 - They know about the power amplifiers with power dissipation and harmonic distortion.
 - The large signal analysis is made.
4. The concept of feedback is well discussed so that they can apply while making their own circuits.
5. Operational amplifiers (QPAMP) are well discussed with their applications so that they can understand the principle behind adder, subtracter, differentiator and integrater.
6. They get a good idea of communication with modulation (AM,FM). The transmission idea is well discussed with the knowledge of bandwidth.
 - They know and can run a cathode ray oscilloscope (CRO) with the introductory idea of microprocessor.
7. Apart from the analog electronics this curriculum provides a very good idea of digital electronics using different gates and Boolean algebra. They also learn about the sequential circuits with the logic how they are used in practical life.
 - Last but not the least they get an idea of binary transmission of information with different methods like Amplitude Shift Keying and FSK

PAPER: 505 (PRACTICAL)

1. The students are made to study the hydrogen spectrum by using plane transmission grating and spectrometer and hence determine the Rydberg constant.
2. The students are made to draw the characteristic curve of a photo cell and find the maximum velocity of the emitted electrons.

3. The students are made to determine the value of Planck's constant with the help of photo cell a monochromatic filter.
4. The students are made to determine the value of Stefan's constant by electrical method using an incandescent electric bulb.
5. The students are made to calibrate a spectrometer with spectral lines of known wavelength and hence determine unknown wavelength of spectral lines emitted by a given source.
6. The students are made to study the variation of refractive index of the material of a prism with known wavelengths of spectral lines of a source and hence determine the unknown wavelength of a spectral line emitted by a source.
7. The students are made to determine the wavelength of a monochromatic light emitted by given source using a biprism.
8. The students are made to determine the boiling point of the given liquid with the help of a Platinum Resistance thermometer.

PAPER: 506 (PRACTICAL)

1. The students are made to assemble and study the frequency response of an OPAMP in inverting negative feedback mode for three different feedback resistances and hence calculate upper half power point and band width. (Using Breadboard).
2. The students are made to study the transfer characteristic of an OPAMP in negative feedback mode for different feedback loop.(Using Breadboard).
3. The students are made to verify De Morgan's theorem using IC 7400 and 7402. (Using Breadboard).
4. The students are made to study the input and output characteristics of a transistor in CB and CE configurations and determine the alpha and beta of the transistor.(Using Breadboard).
5. The students are made to measure the phase difference between the signal across R and C of an RC network using CRO and hence find the value of the resistor and frequency of the signal source.
(Using Breadboard).
6. The students are made to draw the frequency response curve of RC coupled common emitter amplifier and hence determine 3dB points and band width. (Using Breadboard).
7. The students are made to trace the output wave form of a free running multivibrator for three different frequencies using CRO and hence measure the width of the output pulses and compare them with theoretical values. (Using Breadboard).
8. The students are made to assemble (a) OR, (b) AND, (c) NOT and (d) NAND gate with resistance, diode and transistors using bread board and verify their truth table. (Using Breadboard).

Sixth semester

Paper 601:

Nuclear Physics: The chapter explains about nuclear forces and stability of nuclei.

It also gives the knowledge of alpha decay, beta-decay and gamma-rays in details.

The chapter also gives the knowledge about different nuclear models.

It also gives the details of nuclear reactions, accelerators and its working principles and cyclotron construction and its principle, ionization chamber, etc.

Paper 602:

(a) **Mathematical Methods:** This chapter gives the knowledge of tensors in details.

(b) **Solid State Physics:** The chapter gives the knowledge of structure of solids,, Miller indices, Bragg's law etc.

It also explains about free electron theory, band theory, metal insulator, semiconductors in details.

The chapter explains about super conductivity in details.

It also explains the magnetic properties of solids and related theories in details.

Paper 603:

(a) **Modern Optics:** This chapter explains about optics of crystals, characteristics of laser light, holography, optical fibers and its application.

(b) **Electromagnetic Theory:** The chapter gives in details about electromagnetic field equation, velocity of electromagnetic waves, reflection and refraction of plane electromagnetic waves, Brewster's Law etc.

Paper 604:

(a) **Statistical Mechanics:** This chapter explains about statistical system, Liouville's theorem, etc.

It also gives the different types of statistics in details and their applications.

It also explains about Fermi energy, Fermi distribution etc.

It also gives the knowledge of application of BE statistics.

(b) **Computer Applications:** The students will learn about the mathematical operations like series generations, graph fitting and Runge-Kutta method of solving differential equation and also the Simpson's rule.

PAPER: 605 (PRACTICAL)

1. The students are made to study variation of potential drop with frequency across the inductor, capacitor and non-inductive resistor of a series LCR circuit for an ac signal and hence find the resonant frequency. Compare it with theoretical value.
2. The students are made to determine the Q- factor of a series resonance circuit containing L C and R for three different values of R.
3. The students are made to determine the value of 'J' (the mechanical equivalent of heat) by Callender and Bern's method.
4. The students are made to determine the value of self-induction of a coil with the help of Anderson's Bridge.
5. The students are made to determine the constant of a ballistic galvanometer by using a capacitor charged to a known potential difference.
6. The students are made to study the ripple factor of a half-wave and full-wave rectifier using semiconductor diode and L and Π section filter.(Using Breadboard).
7. The students are made to measure the phase difference between the signal across R and C of an R-C network using CRO and hence find the value of the resistor and frequency of the signal.
8. The students are made to determine the temperature coefficient of the material of a given wire.

PAPER: 606 (PROJECT AND COMPUTER PROGRAMMING)

PROJECT: Any Experimental project work of any relevant topic within the syllabus of Physics is chosen by the students and is being guided by a teacher to carry out the project with a report.

Few of the projects done with our students are mentioned below:

- Study of sound intensities in various sites
- Dual regulated power supply
- Generation of electricity with waste products

(a) COMPUTER PROGRAMMING:

1. The students are made to determine (a) mean, (b) standard deviation and (c) standard error of the given experimental data.
2. The students are made to analyse the supplied experimental data between two variables using least square straight line fitting programme.
3. The students are made to rearrange the supplied numerical data in ascending/descending order and find the largest/smallest number in a given list of numbers.
4. The students are made to solve for the two unknown variables in the given pair of simultaneous equations.
5. The students are made to find roots (real and distinct, real and repeated and imaginary) of a quadratic equation.
6. The students are made to generate Fibonacci numbers up to 200 and also to check whether the given number is a prime number.
7. The students are made to make a scientific presentation of procedure, data analysis and result of any one experiment from Paper-605 using power point.

GENERAL

First semester

Paper 101:

(a) Mechanics and Properties of Matter:

The students get to learn about conservative and non-conservative forces and force as gradient of potential.

They also learn about the moment of inertia and its applications.

Study on gravitation is done by making them understand on topics like Kepler's law on planetary motion, Newton's law of gravitation from Kepler's law, etc

Students are given the knowledge on compound pendulum, elasticity, surface tension and streamline and turbulent flow.

(b) Wave and Sound:

➤ Through this chapter students are brought to learn about Simple Harmonic Motion and particles executing S.H.M. Types of vibrations are also studied.

➤ Principle of superposition of waves, stationary wave and Doppler effect are studied

➤ Students are made to learn on the velocity of sound and the things that affect the velocity of sound. They also learn about ultrasonic waves.

Second semester

Paper 201:

(a) Current electricity:

Problems of electrical network, basic principle of self and mutual inductance are discussed with the students.

Students get to learn about the transient growth and decay of the current for LR, CR and LCR circuit.

Study on AC current and transformer is also done

(b) Electrostatics:

The knowledge on Gauss's law and its application is brought to the students.

Study on capacitor plate is done.

They get to learn about the capacity of the capacitor of different size.

Students are the concept of dielectrics in details.

(c) Magnetism:

The students get to learn in details about how the electric current works as a source of magnetic field.

They study about magnetic dipole

They also get to study about Atomic dipole moment and Langevin's Classical theory of para magnetism.

Third Semester

(a) Heat:

Students are given the knowledge on kinetic theory of gases, Maxwell's law of velocity distribution, etc.

Andrew's and Amagat's experiment are discussed.

The students learn about the Joule-Thomson effect

Phase transitions, Gibbs's phase rule, etc are studied

The student also gets to study about radiations which includes topics like black body radiation, Rayleigh-Jean's law and Planck's law of blackbody radiation, etc.

(b) Thermodynamic:

Various thermodynamic laws are studied and the students are given the knowledge of Carnot cycle.

Various thermodynamic scales of temperature and entropy are studied.

Maxwell's thermodynamic relations and its application is studied.

Practicals:

1. The students are made to study the elongation of a wire by different pulling forces using Searle's apparatus and to find the value of Young's modulus.
2. The students are made to determine the value of g by bar pendulum.
3. The students are made to determine velocity of sound in moist air by resonant air column method.
4. The students are made to determine the specific resistance of the material of the given wire by Meter Bridge and then find the length of wire necessary to construct a one ohm coil.
5. The students are made to determine the emf of a cell using a cell of known emf with the help of potentiometer.
6. The students are made to determine the resistance per unit of the length of meter bridge wire by Carey-Foster method.

Fourth Semester

Paper 401:

Optics:

The students get to learn about the Fermat principle and use it to establish laws of reflection and refraction at spherical surface.

Interference by Fresnel biprism, newton rings, etc are studied

Different types of diffraction classes like Fresnel and fraunhoffer diffraction are studied and also diffracting grating, resolving power of grating, etc

The polarization topic includes the knowledge of production and analyzing of different polarized light, specific rotation, etc.

The students also learns about the Michelson interferometer, laser and its characteristics.

Practicals:

1. The students are made to determine the modulus of rigidity of the material of a rod by static method.
2. The students are made to determine the moment of inertia of symmetrical body about an axis by torsional oscillation method
3. The students are made to determine the focal length of a convex mirror with the help of a convex lens.
4. The students are made to determine the refractive index of a liquid by using plane mirror and convex lens.
5. The students are made to determine the electrochemical equivalent of copper by using an ammeter and copper voltameter.
6. The students are made to determine the value of a low resistance by drop of potential method using meter bridge.

Fifth Semester

Paper 501:

(a) Mathematical Methods:

Concept of vector algebra are given to the student with examples.

Vector calculus is taught to the student with its importance in the field of physics and engineering. Gradient of scalar, and divergence and curl of vector with examples of physics is taught.

Students gets to learn gauss' s theorem, stoke' s and Green' s theorem by making first lean about the line integral, surface integral and volume integral.

The students also gets to learn about he curvilinear coordinates sytem

(b) Atomic Physics:

A brief history on how positive ray was discovered is given to the students. Aston and Bainbridge mass spectrographs is studied

Bohr' s theory of hydrogen spectra, energy level diagram, critical and ionization potentials are studied.

The students gets to learn about the vector atom model which includes spinning electrons,

Pauli' s exclusion principle, normal Zeeman effect, etc.

Students gets to learn about X-ray in details.

(c) Relativity:

This chapter gives the knowledge of Lorentz transformation, length contraction, time dilation and their application to physical situation.

Mass- energy relation and velocity addition theorem is also learned by the student.

(d) Renewable energy sources:

The students get to know about the need and importance of renewable energy.

They also learn about the instrument for measuring solar radiation, etc

Practicals:

1. The students are made to determine the value of μ_H with the help of a deflection and vibration magnetometer.
2. The students are made to determine the surface tension of a liquid by capillary rise method.
3. The students are made to draw I-D curve for the given prism with the help of a spectrometer and hence find the angle of minimum deviation.
4. The students are made to determine the wavelength of sodium light by Newton' s ring.
5. The students are made to determine the coefficient of linear expansion of a rod by optical lever method.
6. The students are made to determine the constant of a ballistic galvanometer by direct method.

Sixth semester

Paper 601:

(a) Nuclear Physics:

Concept of nucleus is given to students.

Students get to learn about total binding energy, binding energy per nucleon, binding energy curve and its significance, etc.

They get to study about the various type of radiations in details

They also get to study about the accelerators and its working principle and ionization chamber, etc

(b) Electronics:

8. Students will learn the relation of voltage of Ampere in P-N junction diode. They will have a brief idea of the Energy bands of diode. LED, Varactor-diode and Zener diode applications are learnt.
 - Clipping and Clamping circuits are discussed.
 - They learn the principle of voltage regulation and hence they often can make a regulated power supply of their own.
9. Different important network theorems are discussed so that they are able to solve complex network with a good numerical approach. In this curriculum, Thevenin, Norton, Millman theorems are discussed along with the very important maximum power transfer theorem.
10. The concept of feedback is well discussed so that they can apply while making their own circuits.
11. Operational amplifiers (OPAMP) are well discussed with their applications so that they can understand the principle behind adder, subtractor, differentiator and integrator.
12. Apart from the analog electronics this curriculum provides a very good idea of digital electronics using different gates and Boolean algebra. They also learn about the sequential circuits with the logic how they are used in practical life.
 - Last but not the least they get an idea of binary transmission of information with different methods like Amplitude Shift Keying and FSK

(c) Electromagnetic waves:

The students get a knowledge on electromagnetic spectrum

They study about the Maxwell's equation of electromagnetic wave, velocity of electromagnetic waves.

(d) Solid State Physics:

The students get the knowledge of structure of solids, Miller indices, etc.

They get to study the different types of bonding in solids and classical free electron theory of metals is also studied by them.

Practicals:

1. The students are made to determine the value of 'g' by Kater's pendulum.
2. The students are made to determine the width of a given slit by observing diffraction pattern of monochromatic radiation and verify it using traveling microscope.

3. The students are made to determine the value of 'J', the mechanical equivalent of heat by Joule's calorimeter.
4. The students are made to draw the characteristics of a given transistor with CB and CE configurations and determine the alpha and beta of the transistor.
5. The students are made to determine the angle of minimum deviation and angle of the prism with the help of a spectrometer and hence find refractive index of the material of the prism.
6. The students are made to assemble OR, AND and NOT gates using diode and transistor and verify their truth tables.

Program Specific Outcome

1. They briefly get a basic relation of nature and science, which is basically met by physics.
2. It gives an exposure of how to utilize the natural resources and their utilization property.
3. It forms the base of communication and information system which is the grass-root for today's technological advancement.
4. Physics forms the base of mathematical application and exploration of universal problems, whether it is space exploration, meteorological observation or data transmission.